IT CORPORATION

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Report

Hazardous Waste Management Facility Study

State of Montana

Montana Department of Health
& Environmental Sciences
Helena, Montana

IT CORPORATION

Report

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HAZARDOUS WASTE MANAGEMENT FACILITY STUDY
STATE OF MONTANA

1.0 INTRODUCTION

These investigations were performed by IT Corporation, located in Englewood, Colorado with selected subcontract services provided by Conservation Services, Inc. (CSI) of Aurora, Colorado. The work program consisted of the following two technical tasks:

- Task 1 -- Review and Refinement of Existing Records -- This activity resulted in a review of available information present in the Department of Health and Environmental Sciences, Solid Waste Management Bureau's records and telephone contact of selected waste generators to perform some data refinement.

- Task 2 -- Alternatives Evaluation and Conceptual Design -- This task resulted in the evaluation and analysis of the survey information to define the quantities and types of waste generated in the State of Montana. Mr. Vic Andersen of the Department of Health and Environmental Sciences, Solid Waste Management Bureau assisted our team in this effort. Based on these evaluations, we defined feasible alternative waste management facilities that the State of Montana might consider. We then proceeded to develop a conceptual design/layout with associated cost estimates.

The remainder of this report presents our findings with regard to the types of waste generated, quantities, geographic sources and our opinions regarding predictions. The conceptual design of a hazardous waste container storage facility and a solids disposal facility are provided in Appendix A.

2.0 CURRENT HAZARDOUS WASTE ESTIMATES

2.1 Hazardous Waste Quantities and Types and Location of Generators

Based on our review of the records maintained by the Montana Department of Health and Environmental Sciences, we found the total volume of hazardous waste generated appears to have increased substantially over the reporting time (1981 thru 1983). This information is presented in Table 1.

Table 1. Total Hazardous Waste Volumes Generated

Year	Amount
1981 -	5,900 Tons
1982 -	6,800 Tons
1983 -	11,300 Tons

These figures, in fact do not necessarily reflect an actual increase in the amount of hazardous waste generated but rather reflect the amounts reported. In the three years that the Department of Health and Environmental Sciences has collected records, it has been apparent that each year the records have become more complete and thus more accurate. As a result, we relied heavily on the 1983 reports for this project.

The waste generators were characterized into three major groups from the 1983 data. These are presented in Table 2.

Table 2. Waste Generator Types and Quantity for 1983

Generator Types		Amount
Petroleum Refining	(3 Companies)	5,000 Tons
Pesticide Formulators	(4 Companies)	5,700 Tons
Others	(22 Companies)	600 Tons

In addition, 64 other registered generators did not produce any waste in 1983.

The majority (77 percent) of the hazardous waste generated in the State of Montana during 1983 came from Yellowstone County. Over the last three years, the amount of waste generated in Yellowstone County has averaged 74 percent of the total. Smaller quantities of waste are produced in Cascade, Flathead, Gallatin, Lewis and Clark, Missoula, Park, Ravalli, and Sanders counties.

2.2 Baseload and One-Time Cleanup Volumes

The total hazardous waste volumes generated in the State of Montana (Table 1) consist of two components: a baseload volume and a one-time cleanup volume. The baseload volume is associated with waste generated during routine operations and is normally a function of the production rate or capacity of a particular facility. Normally, if the rate of product production stays constant, the amount of waste also stays constant.

The one-time cleanup volume is generally related to some type of remedial activity. This might be an "old problem" site at an existing or decommissioned facility or it might be related to a spill incident that occurred during that year. Table 3 summarizes the baseload and one-time cleanup volumes for 1983 by type of waste generator.

Table 3. Baseload and One-Time Cleanup Volumes for 1983

Generator Type	Baseload Volumes	One-Time Cleanup Volumes
Petroleum Refining	4,400	600
Pesticide Formulators	4,700	1,000
Others	300	300
TOTALS	9,400 Tons	1,900 Tons

2.3 On-Site Versus Off-Site Disposal and Nature of the Waste

Currently, most generators in the State of Montana treat and dispose of hazardous waste that they generate as part of operations on their own

facilities. For example, in 1983 only 300 tons of the baseload volume was disposed of off-site. In contrast, the entire one-time cleanup volume was disposed of off-site. The majority of off-site disposal takes place outside the state.

In 1983, the 300 tons of baseload waste volume that was disposed of off-site was composed predominantly of organic liquids and sludges that were handled in drums or in bulk. The 1,900 tons associated with the one-time cleanup volume consisted predominantly of hazardous waste contaminated soil material that was typically handled in bulk.

3.0 FIVE YEAR PROJECTIONS

3.1 Baseload Waste Volume, Types, and Location

As part of this project, estimates were developed of waste volume, type and location for a five year period (to 1988) to assist in evaluating the market for an in-state hazardous waste management facility. To aid in projecting the 1988 baseload waste volumes, we interviewed (by telephone) the majority of the major waste generators. This resulted in the baseload volume projection information presented in Table 4.

Table 4. Baseload Volume Projections for 1988

Generator Type	Volume
Petroleum Refiners	3,900 Tons
Pesticide Formulators	150 Tons
Others	600 Tons
TOTAL	4,650 Tons

By comparing this projection against the information for 1983 (Table 3), it becomes evident that with time, the baseload volumes of hazardous waste will decrease by about 50 percent. In addition, it appears that in 1988, about 84 percent of the hazardous waste generated in the State of Montana will come from Yellowstone County. Most of this waste will continue to be treated and disposed of on-site. The volume of waste

that goes off-site is expected to stay similar in quantity and type to the information collected for 1983.

3.2 One-Time Cleanup Volumes

Expectations are that one-time cleanups will continue to constitute a very unpredictable percentage of the total waste volume generated within the State of Montana. The waste from these cleanups is expected to be predominantly contaminated soil which will be disposed of off-site. Of the five current Superfund sites located in Montana, it is our opinion that on-site containment appears to be the likely remediation for all five. Indications are that only one of the five will likely have some contaminated soil removed for off-site treatment/disposal.

A preliminary review of potential candidate sites for nomination to the Superfund list further suggests that off-site removal of very large volumes of contaminated soils will be uneconomical and that containment systems appear to be the most likely remedial measures. As a consequence, a disposal site in the State of Montana dedicated to the one-time cleanup would not have a predictable annual loading.

3.3 Impact of Lowering the Small Quantity Generator Exemption

Recently, the EPA has been considering lowering the small quantity generator exemption limit. Currently, a small quantity generator is defined as generating less than 1,000 kilograms (2,200 pounds) of hazardous waste in a month. Small quantity generators are generally not subject to regulation under Resource Conservation Recovery Act (RCRA) (some exceptions to this general statement do, however, occur). EPA has been evaluating lowering the exemption limit from 1,000 kilograms to 100 kilograms (220 pounds). The impact of this change, if it is promulgated, is of concern to the Department of Health and Environmental Sciences.

As part of this project, we undertook an evaluation of that impact. The basis for our conclusions is a review of records associated with a survey performed by the Department of Health and Environmental Sciences and a telephone survey performed by us. In general, only a very small percentage of current hazardous waste volumes are contributed by generators that are relatively small.

Our telephone survey contacted several individuals in a number of types of institutions or businesses that might be expected to become hazardous waste generators if the small generator exemption limit were lowered to 100 kilograms. In some of the cases, the potential generators indicated that their inclination would be to closely evaluate their suppliers and, where possible, they would purchase supplies that did not ultimately result in the generation of hazardous waste. Regardless of the efforts to switch to products that result in non-hazardous waste generation, it was evident that many institutions and businesses that currently are exempt would, in fact, generate small quantities of hazardous waste. Unfortunately, as a result of our work, we were not able to provide any semi-quantitative or quantitative estimate of this impact. The difficulty in developing a moderately accurate estimate relates to the small size of our sample and the relatively limited understanding that these institutions/businesses have about the situation and their own potential or actual exposure.

Our conclusion was that a lowering of the exemption limit would result in an initial period of confusion among the new hazardous waste generators. After a period of four to five years the situation would come under adequate control. The annual volume increase would be expected to be quite small (e.g. less than 300 tons). However, the numbers of companies involved with this increment would be quite large and involve a substantial administrative effort on the part of the Department of Health and Environmental Sciences to track and manage the reporting efforts.

4.0 EVALUATION OF ALTERNATIVE HAZARDOUS WASTE MANAGEMENT FACILITIES

As discussed in Section 2.3, in 1983 the baseload waste volume that was disposed of off-site was only 300 tons. This volume is not expected to change significantly (e.g., an order of magnitude) with time even if the small generator exemption is lowered. For 1983, the 300 tons of baseload hazardous waste is characterized in Table 5 below.

Table 5. General Composition of Baseload Waste Volume Going to Off-Site Disposal

Organic Liquids -	55% *
Organic Sludge -	35%
Organic Solids -	10%

*Composed of non-ignitable (52%) and ignitable (3%) liquids

The information base for Table 5 is the Department of Health and Environmental Sciences's records that were reviewed as part of this project. The baseload waste volume being discussed consisted of about 25 distinct waste streams of which most would be expected to be handled or transported in drums or containers. Consequently, the selected waste management method should be able to accommodate containers.

Given the available information, an evaluation of various waste management methods was performed using the collective experience and judgement of our project team. These evaluations are summarized in Table 6.

Based on a review of Table 6, the only facility warranting further evaluation for the baseload volume that is transported off-site is a hazardous waste container storage (transfer) station. Consistent with our scope of work undertaken, a conceptual design was prepared for a 300 ton (1,200 drums) per year facility. This design is presented in Appendix A. To assist the Department of Health and Environmental Sciences in evaluating the option of disposing of one-time cleanup volumes at an in-state facility, we also prepared a hazardous waste solids disposal

Table 6. Evaluation of Alternative Hazardous Waste Management Facilities

MANAGEMENT METHOD/FACILITY	CAPITAL COSTS	OPERATING AND MAINTENANCE COSTS	REMARKS
Thermal Oxidation	High	High	Quantities of projected waste materials are too small and system would also require a disposal site for residues.
Deep Well	Low to Moderate	Low to Moderate	Types of waste projected are not very amenable to this management method.
Land Treatment	Low	Low to Moderate	Types of waste projected are not very amenable to this management method.
Treatment	Moderate	Moderate	Variety of waste types would require several treatment methods.
Solidification	Low	Low	Method would require solids disposal site to be amenable to baseload volumes and types.
Container Storage/ Transfer Station	Low	Low	Variety of waste and volume may make this management method viable.
Landfill Site	Low	Low to Moderate	For baseload waste types projected, this management method would require waste to be solidified.

facility (landfill) conceptual design. The landfill design for a 300 cubic yard per year facility is presented in Appendix A.

Based on our conceptual designs presented in Appendix A, estimated costs for constructing (capital), operation and maintenance of the facilities were developed. The estimated costs are summarized in Table 7 and presented in detail in Appendix A.

Table 7. Summary of Estimated Capital, Operation and Maintenance Costs

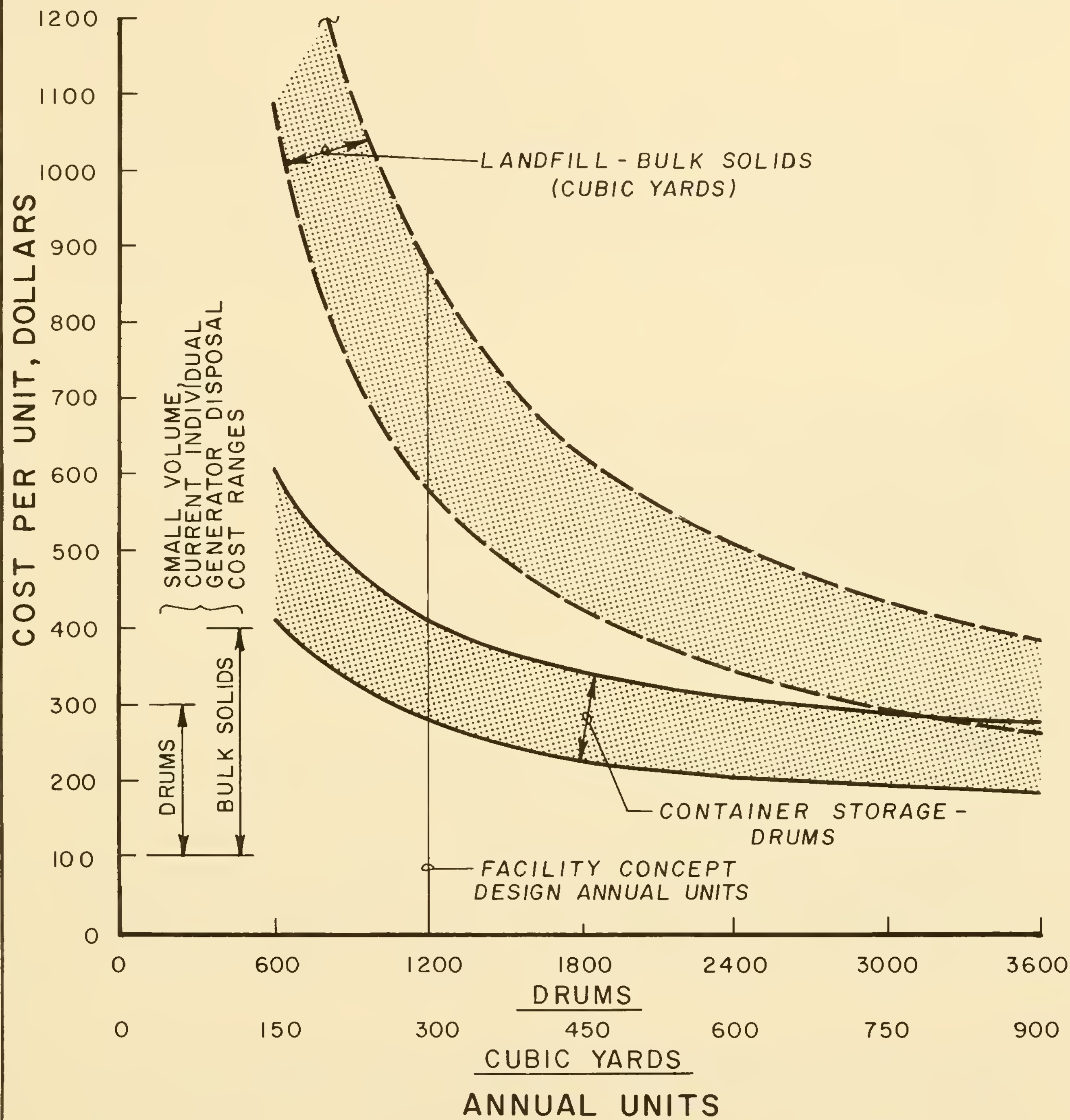
FACILITY	ESTIMATED COSTS (IN THOUSANDS) CAPITAL	OPERATION	MAINTENANCE
Container Storage (1,200 drums per year)	$380-470	$300-450 per year	$10-20 per year
Landfill (300 cy per year)	$480-600	$110-170 per year (plus $60-90 every 2 yr.)	$10-20 per year

The costs provided in Table 7 above are rounded off and the cost to purchase land for the facilities is not included.

The equivalent cost per unit (i.e., drum or cubic yard) for both facilities is shown in Figure 1 for a range of annual volumes. The curves in Figure 1 were based on the costs provided in Table 7, including capital costs, for a 20 year facility life.

The range of estimated costs currently being paid by individual generators to dispose of drums or soils at out-of-state facilities is also provided in Figure 1. The costs for individual generators were estimated based on current transportation and disposal rates. The range reflects the volumes of waste and the varing haul distance to the out-of-state facility. Figure 1 shows the effect on the unit cost of an increase in the annual volume of waste handled by an in-state facility. At an annual volume of about 1.5 to 2.0 times greater than the concept design annual volumes, the cost per unit for the in-state facilities is within the range of current estimated costs.

Considering the economics of the situation, it is unlikely that a commercial concern would invest the required capital to provide such facilities. However, considering the potential environmental and



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NOTE:

COSTS BASED ON 20-YEAR FACILITY LIFE. CAPITAL AND ANNUAL OPERATION AND MAINTENANCE COSTS INCLUDED.

FIGURE 1

COST PER UNIT
CONTAINER STORAGE AND
LANDFILL FACILITIES

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administrative benefits that could accrue, it may be in the State of Montana's interest to heavily subsidize such facilities. In other words, by preferrentially pricing this service to the generators, the State of Montana could provide its institutions/industry/citizens with a strong incentive to handle hazardous waste in a highly responsible manner.

5.0 CONCLUSIONS

Based on our review and evaluations, the current annual baseload volume of hazardous waste generated in the State of Montana is estimated to be about 9,400 tons (1983). Of this baseload, only about 300 tons are transported off-site to commercial waste management facilities all of which are located out-of-state. Our projections for the next five years show that the total baseload volume should decrease to about half of the current volume with the component that is transported off-site staying essentially the same.

One-time cleanup volumes are highly variable on an annual basis and were not considered to be an adequate basis on which to design a hazardous waste management facility. Considering this information in concert with the information regarding a container storage facility presented in Appendix A and Chapter 4.0, it is our opinion that the economic viability of establishing a commercial facility within the State of Montana is quite low.

If it were determined that a hazardous waste management facility was in the interest of the State of Montana, we expect, because of the small volumes of waste involved, that state funding would be necessary to subsidize the operation. To assist the Department of Health and Environmental Sciences in their collective evaluations, it was determined that the two most logical facilities for consideration were: (a) a container storage facility; and (b) a solids disposal facility. The container storage facility would be oriented toward the relatively small

existing generators and any additional generators that would be created by lowering the small quantity generator limit. The solids disposal facility would be oriented to handling some portion of the one-time cleanups. Conceptual designs of both of these facilities have been prepared and are presented in Appendix A. These conceptual designs include siting, design, construction, and operation and maintenance considerations as well as capital, operation and maintenance cost requirements.

The container storage facility was designed to handle 300 tons (1,200 drums) of liquids and sludges in drums per year. Expectations are that this facility would be located in a town or city with municipal services (sewer and water). This design capacity could be increased by expansion of the facility.

The solids disposal facility is a landfill designed to handle 300 cubic yards (contaminated soil) in bulk per year. Expectations are that this facility would be located in a rural area. The capacity of the landfill could easily be increased if the need presented itself.

Both of these facilities will be expensive to build, operate and maintain primarily due to the small volume of waste expected to be handled. As a result, costs in excess of standard commercial rates would require a significant subsidy which may or may not be acceptable to the State of Montana.

Respectfully Submitted,

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APPENDIX A

DESCRIPTION OF HAZARDOUS WASTE MANAGEMENT FACILITIES

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A.1 INTRODUCTION

The concept developed for management of hazardous wastes generated within the state consists of the following two facilities: (a) a container storage facility; and (b) a landfill facility. The container storage facility will manage liquid and semi-liquid wastes. Only wastes contained in drums will be accepted at this facility. Waste materials will be held until a quantity of compatible wastes are collected and then they will be transported to a licensed, out-of-state hazardous waste treatment and disposal facility.

The landfill facility will manage solid, hazardous waste contaminated soil. This facility will store wastes permanently in cells designed to minimize the potential for leakage, and in accordance with applicable federal and state regulations.

The following sections discuss factors which were considered during development of each facility concept. Descriptions include concept design and operation, and estimated costs (capital, operational, and maintenance). Figures A-1 and A-2 present the concept designs for each facility.

A.2 CONCEPT DESIGN FACTORS

Development of the concept designs for each facility involved consideration of several categories of factors. These categories and a discussion of the factors considered follow:

- o <u>Siting</u> -- Factors related to siting include applicable regulations, types of waste involved, and type of facility. Since selection of a specific site for each facility was not part of the scope of work for this project, specific site evaluations were not conducted. However, factors which should be considered when siting a facility are discussed.

- o <u>Design</u> -- Factors related to the design of each facility included federal and state regulations,

volume and types of waste, environmental safety, personnel safety, and economics.

- o <u>Construction</u> -- Factors related to construction of each facility included chemical compatibility of construction materials with the wastes, use of available materials, ease of construction, and economics.

- o <u>Operation</u> -- Factors related to operation of the facility included applicable regulations, safety, security, protection from the elements, and economics.

State of Montana hazardous waste regulations were reviewed and determined to be relatively similar to the federal regulations. However, since the state regulations have not been approved at this time, the federal regulations were used.

Discussion of how the above factors were considered in each of the concept designs is presented in the facility descriptions which follow.

A.3 CONTAINER STORAGE FACILITY

A.3.1 Design Criteria

The container storage facility is designed to temporarily store drums of liquid and semi-liquid wastes and minimize the release of hazardous materials to the environment during an accident or an emergency. The storage building is designed to store approximately 300 drums. This capacity is based on an estimated annual waste volume of 1,200 drums with quarterly shipments to an out-of-state licensed treatment and disposal facility.

The facility site is expected to be located near a city and the concept design considers city utilities (water and sewer) and services (fire protection) to be available. This criterion was based on the review of waste generators and their general location.

A.3.2 Facility Description

General -- Figure A-1 presents the layout of the container storage facility. The storage facility is located on a lot with approximate dimensions of 190 feet by 150 feet. This includes the 50 foot buffer zone between the storage building and the permit boundary fence line as required by RCRA regulation 40 CFR 264.176. The buildings are oriented with southern exposures to be more energy efficient and to allow for the use of solar panels for more efficient heating.

The storage building is 75 feet by 50 feet in size and the support building is 20 feet by 30 feet. An enclosed, covered walk-way connects the buildings. The two buildings are separated for safety and economical considerations. The "clean" operations (chemical analyses, decontamination and office work) will be conducted in the support building and will be protected from wastes located in the storage building. The separation between the buildings will be beneficial in case of a fire or explosion in the storage building because the control center for the fire suppression system is located in the support building. Since the purposes of the buildings are different, it was determined to be more economical to design two separate structures rather than one.

Monitoring wells are located around the site to provide a means of monitoring the ground water beneath the site. No contamination from the facility is expected because of the safety features included in the design concept. However, installation of the wells are included as an additional safety and environmental sensitivity consideration.

Site -- The site was assumed to be located within or near a city with municipal services available. The site should be in an industrial type area away from residential or commercial facilities. RCRA location standards (40 CFR 264.18) require a facility to be located a minimum distance from recent earthquake faults and include special evaluations if the facility is located within a 100 year floodplain boundary. It is

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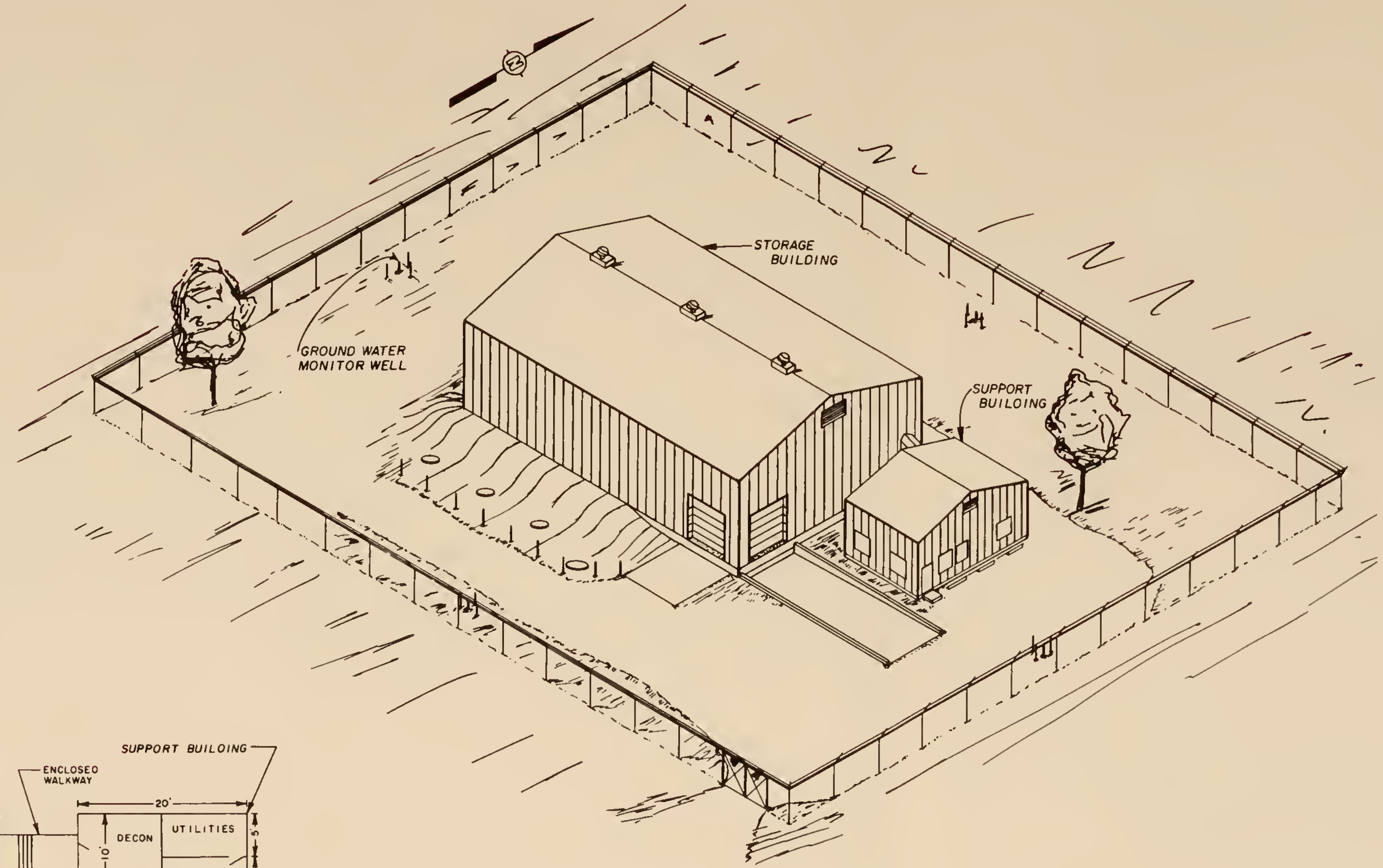
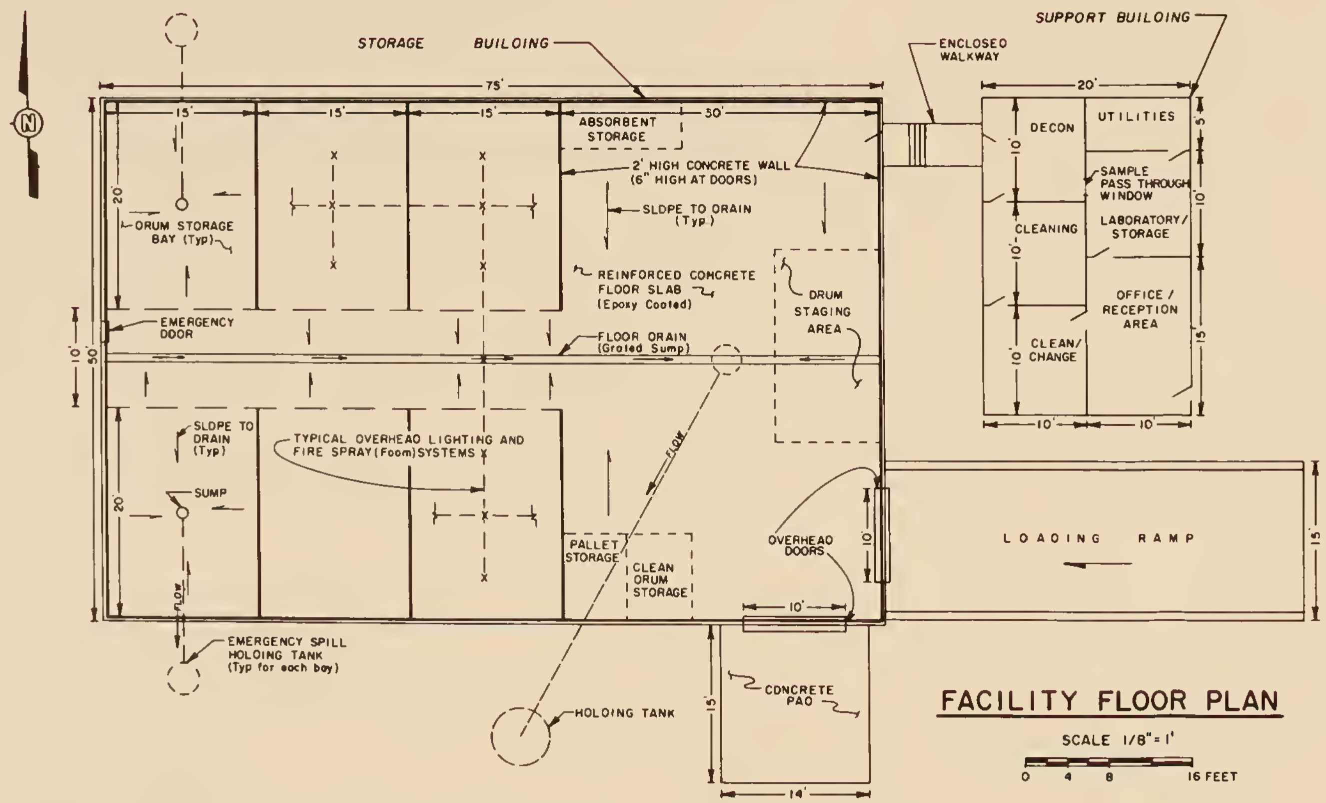


FACILITY SITE PLAN

PICTORIAL VIEW
SCALE 1/16" = 1'
(ISOMETRIC PROJECTION)
0 8 16 32 FEET



FACILITY FLOOR PLAN

SCALE 1/8" = 1'
0 4 8 16 FEET

FIGURE A-1

CONTAINER STORAGE FACILITY
CONCEPT DESIGN

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recommended that the site not be located within a 100 year floodplain and that it also be located away from any major water body, since an accidental spill would readily contaminate nearby water bodies. The site should also be located in an area which has a deep ground water table. The ground water should not be used as a drinking water supply to minimize the environmental sensitivity of the facility.

Support Building Description -- The support building has outside dimensions of 20 feet by 30 feet and contains an office, laboratory and decontamination facilities. Personnel will not be allowed into this building once they have been in the storage building unless they decontaminate properly. The support building is insulated and heated in the winter. The building is connected to a city water supply and sewer system. However, a collection tank will hold used water from the building until it is determined safe to be discharged into the city sewer or it will be placed in drums and placed in the storage building as waste. The function and description of each of the facilities within the support building follows:

- Office -- All paperwork is conducted in the office. Records of incoming and outgoing shipments, laboratory work, and air and water monitoring results are filed in the office. An intercom system is included so the office can communicate with other areas of the support building and with the storage building. An outside line of communication is maintained for routine work and for emergency situations. The office also serves as the lunch room for the facility employees.

- Laboratory -- The laboratory will have the analytical capability to characterize the incoming waste so that it may be properly staged in the storage building. In the laboratory, samples from each drum of incoming waste are described according to reactivity, cyanide content, pH and ignitability. The laboratory also maintains the monitoring equipment to be used in the storage building. These instruments

analyze for radioactivity and organic vapors. The laboratory has a ventilated workbench and an emergency shower and eyewash station.

- Decontamination Facilities -- Within the support building, there is a three stage decontamination facility. As personnel leave the storage building they will proceed to the support building via the covered walkway. The walkway leads to the decontamination room, where the worker will leave their clothing and equipment which could potentially be contaminated. The clothing and equipment will be cleaned and/or stored in a locker. From here, the worker enters the cleaning room where there is a shower, toilet and lavatory. Once the worker has showered, they enter the clean change room and put on their street clothes. The decontamination facilities also include personal lockers and a closed system clothes washer and dryer. All shower and washer water will be piped to a temporary storage tank until it can be analyzed and proper disposal determined.

Other items in the support building include the following:

- First aid kits
- Stretcher and blankets
- Resuscitator and oxygen kit
- Self Contained Breathing Apparatus (SCBA)
- Chemical fire extinguishers

The control center and the concentrated foam fire suppressent for the storage building are also located in the support building. This system can be activated automatically with heat sensitive detectors or manually from within the storage building or the support building.

Storage Building -- The storage building is 75 feet by 50 feet with a 20 foot eave height. The building has wind turbine fans on the roof and electric (non-sparking) fans at the ends of the building for ventilation. The structure is built on a reinforced concrete mat foundation

(epoxy coated). The foundation has a two foot high wall around the inside perimeter of the building to contain spills and reduce the potential for damage to the building walls. There are two overhead doors for delivery and removal of drums from the building. There is one access door to the storage building at the walkway from the support building. At the opposite end of the building there is an emergency exit door. There is an overhead automatic spray system which will suppress a fire with foam. The control center and the concentrated foam equipment are located in the support building.

Within the storage building there is a temporary drum staging area where drums are checked against the manifest, samples are taken and if necessary, the material is repacked in a new drum. The storage building has been divided into six separate bays with individual drain systems. The purpose of the bays is to segregate potentially incompatible waste types (i.e., acids from cyanides for example). Each bay drains to a sump within the bay. In emergency situations, the sump is equipped with a valve that can be remotely opened to release the contents of that bay to an emergency holding tank located outside of the building. There is a central floor drain system down the center of the building which is designed to collect spills and wash water. This water is piped to a holding tank located outside of the building. This holding tank is the same one used to collect water from the support building.

A.3.3 Facility Operation

The purpose of the container storage facility is to accept small quantities of hazardous waste, categorize that waste and periodically ship compatible loads of the waste to a licensed out-of-state treatment and disposal facility.

Waste will be picked-up from the generators and transported to the container storage facility via a state-owned or a properly permitted haul truck. The waste must be manifested prior to pick-up and a copy of the

manifest will accompany the waste. A shipment of drummed waste will be brought to the storage facility. The driver will check in with the manager of the facility and the manifest will be reviewed. Upon approval of the waste shipment by the facility manager, the driver may back the truck up to the loading dock.

Two facility workers will be properly equipped with protective clothing and equipment to unload the truck. One of the workers may be the driver if a state employee. Depending upon the manner of packing, the drums will be removed with a conventional forklift (to remove drums on pallets) or with a special drum grappler on the forklift (to remove single drums). Each drum will be given an identification number as it enters the storage building. This number will be stenciled on the drum, recorded in a log book, and on the manifest.

Drums will be moved to the staging area where a sample will be taken from each drum and analyzed in the on-site laboratory for characterization. Waste in damaged drums or drums which do not meet Department of Transportation codes will be transferred to approved drums. The drums will not leave the staging area until the analyses are completed. Based upon the characterization result, each drum will be placed with compatible wastes in one of the bays.

When there are sufficient quantities of compatible wastes to be shipped off-site, a licensed hazardous waste hauler will be contacted to remove the inventory. The waste will be manifested and loaded onto the truck on pallets.

When a bay has been emptied, it will usually be steam sprayed and the wash water collected in the sump. The water will be sampled and tested. If it tests hazardous, it will be transferred to drums and held on site as waste. Non-hazardous water will be discharged to the sanitary sewer.

A.3.4 Disposal at Out-of-State Facility

The drums will be held at the storage facility, only temporarily. The drums will be taken to either a licensed, out-of-state facility or possibly the in-state landfill facility for disposal. For estimating the maximum total cost of handling liquid and sludge wastes through the storage facility, it was assumed that the drums will be taken to the out-of-state facility.

Out-of-state disposal was evaluated assuming the Chem-Security facility in Arlington, Oregon would receive the drums. The distance used to estimate transportation costs was 800 miles one-way (from Billings in Yellowstone County). Disposal at out-of-state facilities other than Chem-Security is possible. Facilities presently exist in Idaho and Utah, about 200 miles closer to Billings. Transportation costs for these facilities may be lower because of the shorter distance, but the furthest facility was used to reflect the maximum cost.

In addition to transportation costs, costs for solidification of the liquids and sludges and for disposal will be incurred. These costs are included in the operational costs discussed in the following section.

Other factors may increase the disposal costs substantially. These factors include: some chemicals or wastes may not be accepted by a specific facility and full loads (about 70 drums) of compatible wastes may not be available for transporting. These factors would result in additional shipments of (a) either less than full loads and/or (b) to more than one facility, at a full load transportation cost. This would effectively increase the per drum cost.

A.3.5 Estimated Costs

Estimated costs for construction (capital), operation and maintenance of the facility were determined based on the design described above. The

costs were estimated based on supplier information and previous experience. Cost items include facility development, structures, equipment, supplies, employee salaries and disposal at an out-of-state facility. Costs are presented in 1984 dollars.

Estimated costs for the container storage facility are summarized in Table A.1 and presented in detail in Table A.2. The estimated capital cost is expected to range from about $380,000 to $470,000 (not including the land). The estimated annual operation and maintenance cost ranges from $300,000 to $450,000 including contingencies to cover unknowns and potential wide variations in these costs. The cost per drum equivalent to the estimated annual operation and maintenance costs ranges from about $260 to $390, assuming 1,200 drums per year. The cost per drum is quite high because of the relatively small volume.

TABLE A.1

SUMMARY OF ESTIMATED COSTS
HAZARDOUS WASTE CONTAINER STORAGE FACILITY
STATE OF MONTANA

ITEM(1)	CAPITAL ($)	OPERATION ($/yr)	MAINTENANCE ($/yr)
Facility Development(2)	145,000	2,000	--
Buildings	146,000	6,000	3,000
Monitoring Wells	8,000	2,000	--
Production Employees	--	94,000	--
Production Equipment	55,000	24,000	3,000
Laboratory Equipment	12,000	1,000	1,000
Health and Safety Equipment	5,000	3,000	1,000
First Aid Equipment	1,000	--	--
Emergency Response Equipment	4,000	--	1,000
Disposal at Out-of-State Facility	--	168,000	--
TOTALS (w/o Contingency)	$376,000	$300,000	$9,000
Contingency (Percent of Subtotal)	25%	50%	100%
TOTALS (w/Contingency)	$470,000	$450,000	$18,000

(1) See Table A.2 for detailed description of cost items. Costs rounded up to the nearest $1,000.

(2) Not including cost of land.

TABLE A.2

DETAILED ESTIMATED COST BREAKDOWN
HAZARDOUS WASTE CONTAINER STORAGE FACILITY
STATE OF MONTANA

ITEM	DESCRIPTION	CAPITAL ($)	OPERATION ($/YR)	MAINTENANCE ($/YR)
Facility Development[1]	o Preliminary and Final Design (plans and specifications)	70,000	--	--
	o Permits (construction, RCRA Part B, public hearings)	40,000	2,000	--
	o Construction Management	25,000	--	--
	o State Administration	10,000	--	--
		145,000	2,000	-
Buildings	o Site Preparation (gravel, earthwork)	5,000	--	--
	o Foundation - Support Building	3,000	--	--
	- Storage Building	32,000	--	--
	o Support Building with Office, Laboratory and Decontamination Facilities (20-feet x 30-feet)	30,000	2,000	1,000
	o Storage Building with Floor Drains, Emergency Spill Holding Tanks, Drum Staging and Six Drum Storage Bays (75-feet x 50-feet)	45,000	4,000	1,000
	o Fence	6,000	--	--
	o Foam Spray Fire Control System	25,000	--	500
		146,000	6,000	2,500
Monitoring Wells	o Installation of Four (4) Wells	8,000	--	--
	o Quarterly sampling and analyses	--	2,000	--
		8,000	2,000	--
Production Employees	o Salaries and Benefits[2]	--	94,000	--

TABLE A.2
(Continued)

ITEM	DESCRIPTION	CAPITAL ($)	OPERATION ($/YR)	MAINTENANCE ($/YR)
Production Equipment	o Forklift - Propane (incl. drum grappler)	20,000	5,000	2,000
	o Truck (stakebed with hydraulic tailgage)	30,000	15,000	1,000
	o Miscellaneous Equipment (steam sprayer, wet vacuum,dollies)	1,000	--	--
	o Pallets	1,000	1,000	--
	o Drums	2,000	2,000	--
	o Absorbent Material	1,000	1,000	--
		55,000	24,000	3,000
Laboratory Equipment	o Analytical Equipment (cyanide and pH detector)	3,000	--	100
	o Monitoring Equipment (radiation monitor, organic vapors and vapor indicator tubes)	6,000	--	200
	o Work Bench with Ventilation Hood	2,000	--	--
	o Misc. Laboratory Supplies	1,000	1,000	--
		12,000	1,000	300
Health and Safety Equipment	o Personnel Protective Clothing (coveralls, boots, gloves, goggles and hard hats)	2,000	2,000	--
	o Respirators and Chemical Cartridges	1,000	500	--
	o Decontamination Items (washer and dryer, towels and soap)	2,000	100	100
		5,000	2,600	100
First Aid Equipment	o First Aid Kits, Stretcher and Blankets, and Resuscitator and Oxygen Kit	1,000	--	--

TABLE A.2
(Continued)

ITEM	DESCRIPTION	CAPITAL ($)	OPERATION ($/YR)	MAINTENANCE ($/YR)
Emergency Response Equipment	o Self Contained Breathing Apparatus and Chemical Fire Extinguishers	3,000	--	100
	o Eyewash Stations and Emergency Showers	1,000	--	--
			--	--
		4,000	--	100
Disposal at Out-of-State facility (Chem-Security, Arlington, Oregon)	o Transportation (80 drums per full load; $2800 per load)	--	42,000	--
	o Solidification ($25 per drum)	--	30,000	--
	o Disposal ($40 per drum; number of drums increased 100% by solidification	--	96,000	--
		--	168,000	--

(1)Cost of the land for the facility is not included.

(2)Costs based on two full time employees: one manager or supervisor and one operator/laborer.

A.4 LANDFILL FACILITY

A.4.1 Design Criteria

Criteria used to develop the facility concept design included the following:

- Annual volume of waste material is 300 cubic yards. This waste will consist of solids (no free liquids) or contaminated soils.
- The facility site is located in a rural area. This criterion was based on experience in siting similar facilities and results in the establishment of several other criteria.
- The facility will be open on only a part-time basis. This criterion was based on the small volume of waste generated annually.
- The facility will use multiple cells constructed sequentially. This criterion optimizes the initial capital costs for the facility and provides a mechanism for expansion.
- Each cell will be enclosed during operation by a temporary building. This criterion was based on a need for security because of the rural facility location and part-time operation, and a need to protect the cell from the elements (i.e., precipitation on the cell would result in accumulation of water in the leachate collection system).
- Each cell will be an above grade type cell. This criterion maximizes the distance of the waste above any ground water table which may be present at the site, thereby minimizing the potential for ground-water contamination if for any reason the cell leaks.
- Each cell has a double liner system consisting of a leachate collection layer, a primary liner (synthetic geomembrane), a leachate detection layer, and a secondary liner (synthetic geomembrane). This criterion minimizes the potential for leakage out of the cell and meets the regulations for a double liner cell design.

A.4.2 Facility Description

General -- The landfill facility concept design consists of multiple cells designed to meet federal (RCRA) and state regulations. The facility concept design is illustrated in Figure A-2. The facility is located on a 20 acre site to provide a reasonable operating life for the facility. The facility, as shown, has a life of about 42 years using the estimated annual waste volume of 300 cubic yards per year. Each cell is about 60 feet wide and 150 feet long with a design capacity of 600 cubic yards or 2 years of operation. Each cell is designed as an above grade cell with a double liner system. During operation a cell is enclosed by a temporary building to protect the operation from the elements, minimize leachate generation, and provide security.

Site -- As stated previously, specific sites for each facility were not evaluated for this project. However, siting considerations which should be included when evaluating various sites for a landfill facility are as follows:

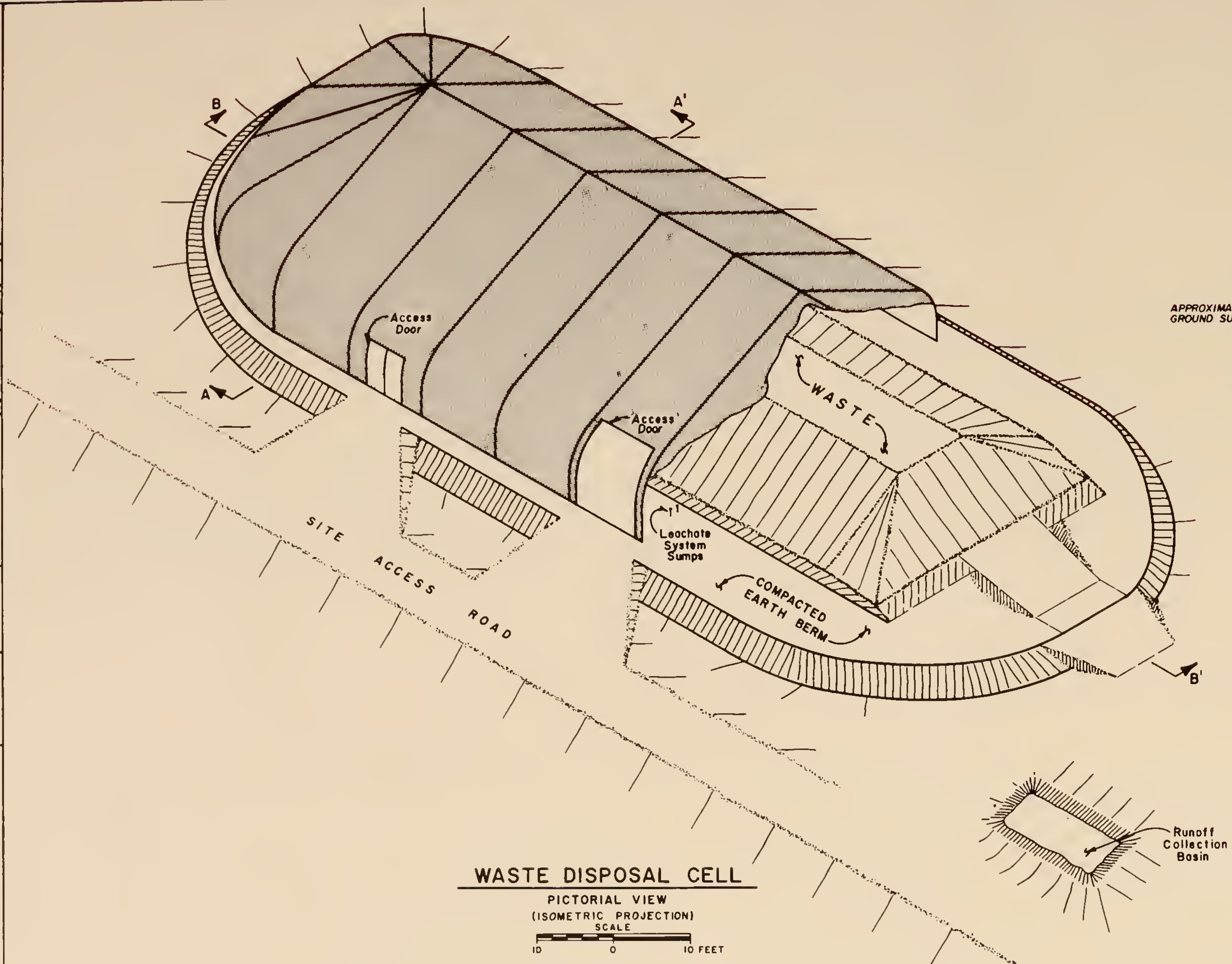
- The site should be located outside of any 100-year floodplain boundary limit. If the site is located within such a limit, then RCRA regulations [40 CFR 264.18(b)] require a demonstration of the adequacy of the facility design against damage due to flooding.

- The site must be located a minimum distance from recent earthquake related faults (200 feet from Holocene age faults) according to RCRA regulation [40 CFR 264.18(a)].

- Site topography should be flat to gently rolling with no major drainage channels passing through the site.

- Site geology should include low permeability soils or underlying bedrock units such as claystones or shales. Low permeability materials will reduce the potential for leakage from the cells and possible migration of contaminants.

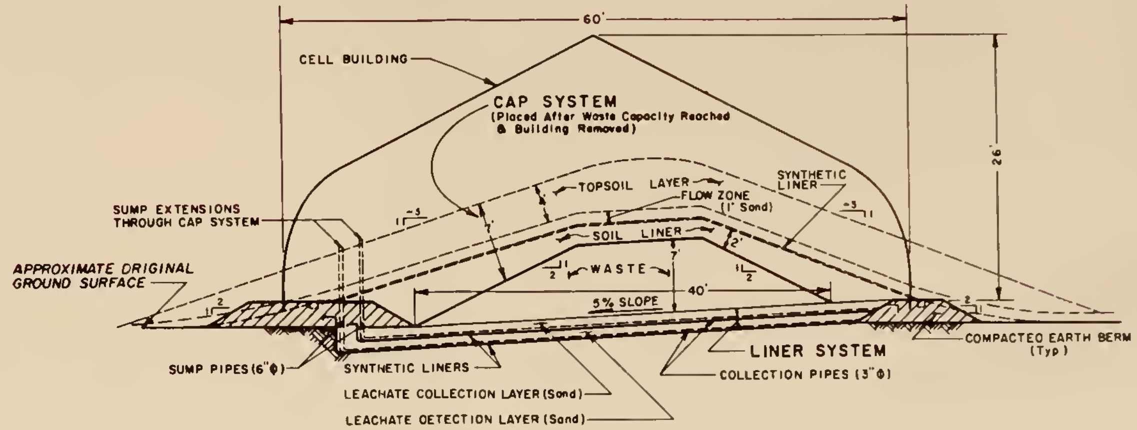
DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
R D B 5-18-84	CEO 6/27/84	[handwritten initials] 6/27/84	846087-E2



WASTE DISPOSAL CELL

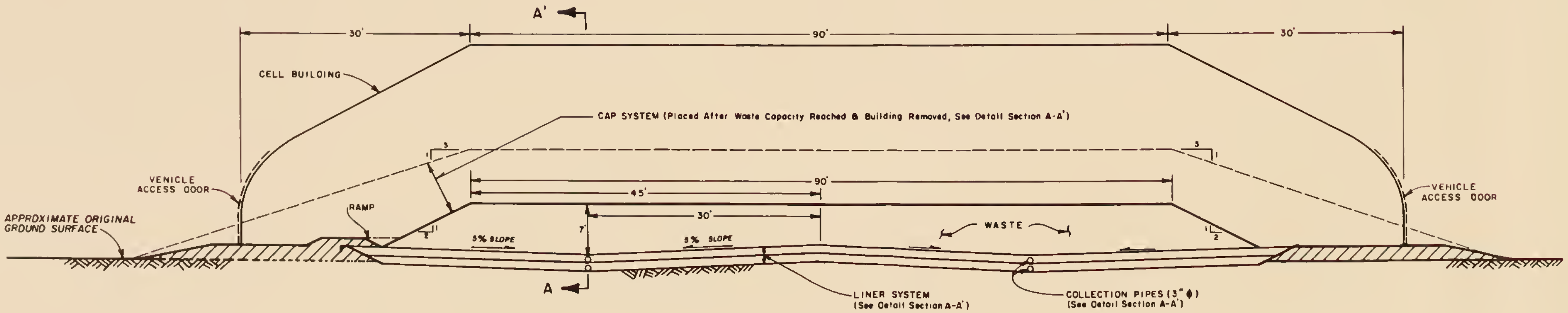
PICTORIAL VIEW
(ISOMETRIC PROJECTION)

SCALE 10 0 10 FEET



CROSS SECTION A-A'

SCALE 10 0 10 FEET
1/8" = 1'



CROSS SECTION B-B'

SCALE 10 0 10 FEET
1/8" = 1'

FIGURE A-2

LANDFILL FACILITY
CONCEPT DESIGN

PREPARED FOR

MONTANA DEPARTMENT OF HEALTH
& ENVIRONMENTAL SCIENCES
HELENA, MONTANA

IT CORPORATION

- o Ground water within and around the site should be located at a substantial depth below ground surface, and not be used as a major source of drinking water in the area. Such a site will have minimal impact on the ground water if leakage should occur.

The facility will be secured by a fence around the entire perimeter with access controlled through one gate. A 100 foot wide buffer zone between the property boundary and cells is recommended so waste materials are not placed adjacent to the site boundaries. Surface water drainage control on the site includes diversion ditches located along the site boundaries. The diversion ditches will direct runon of uncontaminated surface water around or away from the site. A system of collection and diversion ditches within the site will also be constructed sequentially as the facility, is developed to divert runon around or away from operating areas and collect runoff from operating areas. Any runoff collected will be considered potentially contaminated and will require analysis to determine if it can be safely discharged or if it requires treatment.

Cell -- Each cell contains an above grade waste pile 40 feet wide, 120 feet long and 7 feet thick as shown in Figure A-2. The waste is contained by a double bottom liner system and enclosed by a temporary type building. The cell is located above grade because the distance from ground-water table is maximized, earthwork excavation is minimized (lowers construction costs), and construction of the double liner system is simplified by eliminating placement of the liner system components on excavation side slopes.

The double bottom liner system consists of several components as shown in Figure A-2. The system is designed to meet RCRA regulations, (40 CFR 264.302) and has a slope (5 percent) both into the cell and to the side of the cell to promote drainage of any leachate by gravity to collection pipes and sumps. The components of the liner system from top to bottom are:

- Leachate Collection Layer -- This is a one-foot thick clean sand layer. It collects leachate from the wastes and prevents leachate accumulation on top of the primary liner. Leachate is removed through pipes and sumps located on the side of the cell.

- Primary Liner -- The purpose of this liner is to prevent leachate leakage from the cell. It is a synthetic geomembrane type liner. Types and thickness of the liner are discussed below. The liner is protected by the sand layers located above and below it.

- Leachate Detection Layer - This layer consists of the same material as the collection layer described above. However, its purpose is to detect and control leachate which has leaked through the primary liner and prevent accumulation of leachate on the secondary liner. Leachate is removed from this layer through pipes and sumps located on the side of the cell.

- Secondary Liner -- The purpose of the secondary liner is to contain leachate which leaks through the primary liner. It is the same type of material as the primary liner as discussed below.

Many types of synthetic geomembrane liner materials are available. The type selected for use should be evaluated for chemical compatibility with the chemicals expected in the cell during final design. The types of liner materials considered most resistant to a wide variety of chemicals are high density polyethylene (HDPE) and chlorosulfonated polyethylene (Hypalon). Liners are also available in a variety of thicknesses from 10 to 100 mils (0.010 to 0.100 inches). Liner thickness on the order of 60 mils is considered appropriate for this facility since the design thickness in each cell is only seven feet.

The system is shown with two synthetic geomembrane liners. However, a lower liner of compacted clay could be used instead of the lower geomembrane if a suitable clay source is located within a relatively short

distance from the site. If a compacted clay type lower liner were used it should be about two to three feet thick.

The waste in a cell will be covered by a permenant cap system after the cell capacity is reached and the temporary building removed. The cap system is shown in Figure A-2 and is designed to meet RCRA regulations (40 CFR 264.310). The system consists of the following components from the bottom to the top:

- Secondary Liner -- A fine grained (clayey) soil liner a minimum of two feet thick is the secondary cap system liner. This layer is placed on top of the waste and graded to direct drainage naturally, off the waste pile with a slope of about 3 to 1 (horizontal to vertical).

- Primary Liner -- The primary liner is a synthetic liner. It is the primary liner to prevent infiltration of precipitation into the cell. It should be a reinforced type geomembrane to resist stresses placed upon it and should also be resistant to degradation by the elements (i.e., sunlight). A Hypalon material is considered appropriate for this liner.

- Flow Zone Layer -- This is a sand layer which will drain infiltrating water off the primary liner and physically protect the primary liner. The layer will also retard root growth and animal burrowing which could penetrate the primary liner.

- Topsoil Layer -- This layer provides a vegetation growth zone and provides protection for the underlying layers from exposure through erosion.

Cell Building -- The cell has been designed to be enclosed by a temporary building to increase security and prevent the accumulation of precipitation within the cell during operation. Elimination of precipitation on the cell is considered particularly critical to this facility since it is located in an area with severe winters. Also, water which accumulates in the cell would have to be removed through the

leachate collection layer and probably treated since it would have been in contact with wastes. Handling this accumulated water could be a major operational problem considering the rural site location and part-time facility operation.

Several types of temporary or semi-temporary buildings are available which could be erected and allow operation of the cell and movement of equipment. The type shown in Figure A-2 is an aluminum frame structure covered with a heavy polyvinyl chloride based fabric. The size of the building is 60 feet wide, 150 feet long and 26 feet high. It is easily erected and dismantled for moving to the next cell. It requires no foundation preparation. Other types of buildings which could also be used are corregated metal arches, and steel frames covered with either fiberglass or metal siding panels.

Support Building -- A support building is located at the main access gate to the facility. The building will contain a small office, personnel cleaning facilities (change room, etc.), and provide secure storage for site equipment and vehicles. The building concept is the same as the buildings used at the container storage facility, i.e., a pre-engineered structural steel building with metal siding. The building size is 20 feet by 20 feet.

Equipment -- Equipment considered for the landfill facility includes a front end loader for placing the wastes in the cells, a one ton pick-up truck for travel to and from the site and on-site, a portable pump for pumping leachate from the cell sumps, portable scale for weighing vehicles delivering wastes, and a portable sprayer for washing down the vehicles. The pickup truck, pump, and sprayer would probably be used at both facilities. Laboratory equipment for analysis of water samples from the sumps and runoff collection basins would be kept at the container storage facility.

Personnel safety equipment kept at the landfill facility would include basic first aid supplies and protective clothing, i.e., coveralls and gloves. Extra equipment and supplies would be available and stored at the container storage facility.

A.4.3 Facility Operation

The facility will be open on a part-time basis employing the same personnel which operate the container storage facility. Wastes will be brought to the site by the generators (or their contractors) and will not be picked up by the facility workers.

When a load of waste arrives at the facility, the truck will be weighed and the supervisor will complete the necessary forms. The truck will then be directed to the appropriate cell to dump the waste. A facility worker will accompany the truck and direct the dumping operation. Waste will be dumped at the end of the cell inside the building. After dumping, the waste truck will return to the support building to be weighed and to complete the necessary forms. The fee to be charged will be determined based on the weight of waste material dumped.

Wastes will be placed with the front end loader. The loader will be operated by a facility employee and work monitored by the second employee for safety of operation. The loader will place the waste in thin uniform layers and compact it by wheel rolling with the loader. Compaction is important to reduce the waste volume and to minimize the amount of waste settlement with time which could result in some distress to the cap system. The loader will be routinely left inside the operating cell building to prevent the spread of on-site contamination. For maintenance or when the facility may be closed for an extended period during the winter, the loader will be washed down (decontaminated) to remove waste material from the tires, bucket, and frame, and driven to the support building.

Routine operations in addition to handling the waste will include monitoring the sumps for the operating and closed cells, pumping out the sumps if leachate is detected, and sampling the ground water monitoring wells. Routine maintenance at the facility will be minimal. Expected items include semi-annual loader maintenance and clean out of the diversion ditches.

A.4.4 Estimated Costs

Estimated costs in 1984 dollars for facility development and construction (capital), operation and maintenance were determined based upon the facility concept design described above and estimated costs obtained from suppliers and previous experience. A summary of the estimated costs are provided in Table A.3 and a detailed breakdown is given in Table A.4. The estimated capital cost for the facility is about $480,000 to $600,000 (not including land). The estimated annual operation and maintenance costs range from $120,000 to $190,000 or about $410 to $640 per cubic yard. The cost per cubic yard is very high because of the small volumes involved.

At two year intervals a new cell will be constructed, new monitoring wells installed around it, the completed cell covered, and the cell building moved to the new cell. The total estimated cost for this work is about $60,000 to $90,000 as shown in Table A.3. Including these expansion costs, on an equivalent annual basis, the costs per cubic yard range from $510 to $790.

TABLE A.3

SUMMARY OF ESTIMATED COSTS
HAZARDOUS WASTE LANDFILL FACILITY
STATE OF MONTANA

ITEM(1)	CAPITAL ($)	OPERATION ($/yr)	MAINTENANCE ($/yr)
Facility Development(2)	185,000	2,000	--
Site	173,000	0	1,000
Support Building	26,000	2,000	1,000
Monitoring Wells	8,000	2,000	--
Production Employees	--	94,000	--
Production Equipment	79,000	10,000	8,000
Health and Safety Equipment	3,000	3,000	--
First Aid Equipment	1,000	--	--
Emergency Response Equipment	4,000	--	1,000
TOTALS (w/o Contingency)	$479,000	$113,000	$11,000
Contingency (Percent of Total)	25%	50%	100%
TOTALS (w/Contingency)	$599,000	$170,000	$22,000
EXPANSION WORK EVERY TWO YEARS			
Construction of New Cell	--	30,000	--
Install Four Monitoring Wells Around New Cell	--	8,000	--
Cap Completed Cell	--	15,000	--
Move Cell Building	--	5,000	--
TOTAL (w/o Contingency)	--	$58,000	--
Contingency (percent of subtotal)		50%	
TOTAL (w/Contingency)		$87,000	

(1)See Table A.4 for detailed description of cost items. Costs rounded up to the nearest $1,000.

(2)Not including cost of land.

TABLE A.4

DETAILED ESTIMATED COST BREAKDOWN
HAZARDOUS WASTE LANDFILL FACILITY,
STATE OF MONTANA

ITEM	DESCRIPTION	CAPITAL ($)	OPERATION ($/YR)	MAINTENANCE ($/YR)
Facility Development[(1)]	o Preliminary and Final Design (plans and specifications)	100,000	--	--
	o Permits (construction, RCRA Part B, public hearings)	60,000	2,000	--
	o Construction Management	15,000	--	--
	o State Administration	10,000	--	--
		185,000	2,000	--
Site (Including One Cell)	o Earthwork (diversion ditches, roads)	6,000	--	--
	o Fence	27,000	--	--
	o Cell (1)	30,000	--	--
	o Cell Building (material and erection)	110,000	--	1,000
		173,000	--	1,000
Support Building	o Foundation	3,000	--	--
	o Building (20 ft. x 20 ft.)	20,000	2,000	500
	o Miscellaneous (water tank, lighting)	3,000	--	--
		26,000	2,000	500
Monitoring Wells	o Installation of Four (4) Wells	8,000	--	--
	o Quarterly Sampling and Analyses	--	2,000	--
		8,000	2,000	--
Production Employees	o Salaries and Benefits[(2)]	--	94,000	--

TABLE A.4
(Continued)

ITEM	DESCRIPTION	CAPITAL ($)	OPERATION ($/YR)	MAINTENANCE ($/YR)
Production Equipment	o Front-End Loader (1-3/4 cubic yard)	58,000	5,000	6,000
	o Truck (1-ton)	15,000	5,000	1,000
	o Portable Scale	5,000	--	500
	o Miscellaneous (steam sprayer, pump)	1,000	--	--
		79,000	10,000	7,500
Health and Safety Equipment	o Personnel Protective Clothing (cover-alls, boots, gloves, goggles and hard hats)	2,000	2,000	--
	o Respirators and Chemical Cartridges	1,000	500	--
		3,000	2,500	--
First Aid Equipment	o First Aid Kits, Stretcher and Blankets	1,000	--	--
	o and Resuscitator and Oxygen Kit			
Emergency Response Equipment	o Self Contained Breathing Apparatus and Chemical Fire Extinguishers	3,000	--	100
	o Eyewash Stations and Emergency Shower	1,000	--	--
		4,000	--	100

(1) Cost of the land for the facility is not included.

(2) Costs based on two full time employees: one manager or supervisor and one operator/laborer.